Revolutionizing Mathematics Education: An Experimental Study On the Impact of Technology Integration

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ABSTRACT

This study endeavored to determine the significance of the impact of technology integration to the academic achievement of the students in mathematics. The utilized quantitative research design, specifically, quasi-experimental approach. A total of 24 students were assigned in the control group while 25 students were assigned in the experimental group who were assigned in random. The instruments used was researcher-made questionnaire that underwent pilot-testing and was validated by the panel of experts. Descriptive analysis revealed that the level the competency level of both control and experimental group during the pretest is very low, implying that both groups are equal before the intervention. The posttest score of the control group is higher than the control group. Meanwhile, t-test revealed that there is a significant difference between the pretest and the posttest scores of the control group. Finally, there a significant difference between the pretest and the posttest scores of the experimental group. The findings were indicative on the effectiveness of technology integration in elevating the academic achievement of the students in mathematics.

Keyword : *academic achievement, mathematics, quasi-experimental research design, Davao de Oro, Philippines*

1. INTRODUCTION

The 21st century classroom teachers are expected to revolutionize mathematics education by providing personalized learning experiences. By integrating technology in the instructional materials, educators can create adaptive and dynamic learning environments that cater to the individual needs and learning styles of students [3]. Despite of the drive to integrate technology, [2] showed that there was still evidence of learning loss. Simultaneously, a study conducted by [5] revealed that Germany had a decline in Mathematics performance over the previous academic year, coinciding with the closure of schools, in comparison to previous years.

In the Philippines, a study conducted in Pampanga revealed that revolutionizing Math class using Octalysis framework showed promising results. The primary objective of this study was to facilitate the learning process for students by offering an alternate method and this was achieved through the utilization of technology integration through game-based approach. By utilizing a specialized mobile application, students have the opportunity to actively engage in the educational process, potentially enhancing their understanding and retention [4]. Hopefully, this may help in improving the poor performance in Math as evident in the international assessment.

In the academic year 2023-2024, within the Division of Davao de Oro, it was observed that a portion of the students enrolled in public secondary schools did not attain the expected level of proficiency in Mathematics. Given these considerations, the researcher determined it to be imperative to undertake the study in order to generate empirical evidence on the impact of technology integration in teaching mathematics to the students' academic achievement. The findings of this study will be crucial for instructional leaders and teachers in order to effectively provide suitable scaffolding for learners. This approach has the potential to facilitate the development of pupils as autonomous learners.

2. METHODS

A quantitative, quasi-experimental research design was utilized in this investigation. The chosen methodology will be deemed suitable as it aligns with the objective of generating empirical data regarding the efficacy of the proposed intervention. According to [1], the utilization of experimental research design enables the collection, analysis, and interpretation of data. Moreover, research endeavors that aim to examine a hypothesis grounded on proven theories should be approached using quantitative methods.

The use of quasi-experimental design aligns with the research objectives as it aims to assess the efficacy of the intervention by comparing the incremental scores of both the experimental and control groups. Specifically, This will be employed to realize if the intervention bears resemblance to the control group, yet lacks the crucial element of random assignment.

Further, this entails collecting a pretest measurement of the end variable before implementing any intervention, and subsequently conducting a posttest using the same measurement after the intervention has been administered. Pretest-posttest was administered in experimental and control groups. Moreover, while the adaptability of pretest-posttest designs, it is important to acknowledge that they possess inherent limits, most notably the potential for internal validity concerns.

2.1 Research Locale

The study was conducted in Magsaysay National High School, Nabunturan West District, Division of Davao de Oro. Magsaysay National High School is a public school located in Barangay Magsaysay, Nabunturan, Davao de Oro, Philippines. It was establish in the year 2010 as an Annex school of Nabunturan National Comprehensive High School that offers Junior High School for students from grades 7 to 10. As a brief history of the place, formerly, barangay Magsaysay is a sitio inside Barangay Lino-an which is under the Municipality of Compostela where Nabunturan is the Poblacion. Barangay Lino-an follows the national highway from Km. 91 to Km. 100.

Currently, Magsaysay National High School has a total population of 221 with 11 secondary school teachers. As of this time, the school is fully connected with internet to provide the teachers with access to a wide array of resources.

Nabunturan was formerly a barrio in the Municipality of Compostela. The name Nabunturan was derived from the Cebuano word "buntod" which means 'mountain". The English translation of the word "Nabunturan" is "surrounded by mountains."

Nabunturan is primarily an agricultural town, with major crops including coconut, banana, corn, and rice. It is also known for its mining industry, with gold and copper mines located in the area. In terms of tourism, the town boasts natural attractions such as waterfalls, hot springs, and caves, as well as cultural and historical landmarks like the Nabunturan Municipal Hall and the Nabunturan Public Market.

Currently, the municipality has 43 public schools – 31 elementary schools; 4 integrated school; and 8 secondary schools.

2.2 Research Subjects

This study will utilize the two sections of Grade 8 in the research locale. These sections are under the regular teaching loads of the researcher. Random sampling was utilized to fairly identify which were in the control and experimental group. Random sampling provided each student a fair chance of being included in the study groups thereby reducing the biases of this study. There were a total of 25 students in the control group and 25 students in the experimental group.
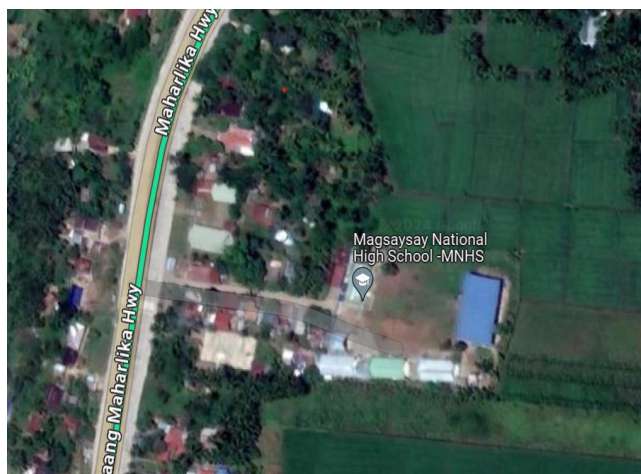
Fig - 1 Location Map of Magsaysay, Nabunturan, Davao de Oro

2.3 Research Instrument

This study utilized a researcher-made test in Mathematics to measure the students' achievement. A panel of experts validated the research instruments to determine their appropriateness in the context of this study. The researcher created a 40-item multiple-choice test questionnaire in Mathematics to measure the academic achievement of the students in this subject. These items were made based on the DepEd's Most Essential Learning Competencies (MELCs) in Grade 8 mathematics for Quarter 3. Additionally, a table of specification (TOS) was made to specify the competencies of each item of the test.

The questionnaire was subjected to content validation and item analysis to ensure that this exactly measured the objectives set forth in the study. A panel of experts was requested to validate the contents to ensure that the questionnaire is within the scope intended for this study.

This was followed by pilot-testing of the instrument. The pilot test was administered to at least 25 students who were not be part of the actual research respondents. Item analysis was performed to ensure that this will exactly measure the objectives set forth in this study.

Parameter Limits	Descriptive Equivalent	Interpretation
80.01 - 100.00	Very high	This means that the academic achievement of the students is outstanding.
60.01 - 80.00	High	This means that the academic achievement of the students is very satisfactory.
40.01 - 60.00	Moderate	This means that the academic achievement of the students is satisfactory.
20.01 – 40.00	Low	This means that the academic achievement of the students is unsatisfactory.
0.00 - 20.00	Very Low	This means that the academic achievement of the students is very unsatisfactory.

2.4 Research Procedure

Permission to perform the study was sought by the researcher. After all protocols have been reviewed and observed, the researcher will get an endorsement letter from the Dean of Graduate School. After that, the researcher will send a letter of approval for the study's conduct to the Office of the Schools Division Superintendent of Davao de Oro, along with the endorsement letter as an attachment. Upon approval, a copy on the permit to conduct the study shall be furnished to the School Principal of the research locale to gain access to the subjects.

The subjects' and their parents' were given a general orientation where the researcher discussed the purpose of the research, the extent of the subjects' participation, mode of data collection, type of data that were gathered, and the mode of data processing and presentation. The ethical considerations was discussed as well. Further, they will be assured that all information were kept confidential.

Subsequently, they were requested to voluntarily sign forms; parental consent for the parents and assent form for the subjects. Digital copies were sent to those who have internet access. However, those who have problems being connected online will be receiving the forms in hard copy. The Inter-Agency Task Force for the Management of Emerging Infectious Diseases has advised that the method of contacting respondent should follow the minimum health standard guidelines (IATF-EID).

The researcher personally administered the research instrument both in pretest and post-test. The administration of the test was in face to face modality. Since there will be 40 items, a maximum of 60 minutes was allotted for the students to complete the test.

Exam papers were personally checked by the researcher. Scores were collated in Microsoft Excel and were sent to the statistician of Assumption College of Nabunturan for processing. The subjects were assigned with numbers or codes instead of their real names. Meanwhile, the interpretation of the data was made by the researcher.

3. RESULTS

This chapter presents the results obtained from the collected data and the subsequent analyses in the sequence corresponding to the problems presented. Data and preliminary information were also provided as the bases for the computation and interpretation of results.

Group	Number of Students	Mean	Class Proficiency	Competency Level
Control	24	6.43	16.08%	Very Low
Experimental	25	7.02	17.55%	Very Low

Table 1 Mean Pretest Scores of the Control and Experimental Group

The pretest mean scores of the control and experimental group are presented in Table 1. It can be gleaned from the table that control group has a mean of 6.43, a proficiency of 16.08% and with a competency level of very low. On the other hand, the experimental group has a mean of 7.02, a proficiency of 17.55% and with a competency level of very low.

Group	Number of Students	Mean	Class Proficiency	Competency Level
Control	24	7.08	17.7%	Very Low
Experimental	25	10.05	25.13%	Low

Table 2 Mean Post-test Scores of the Control and Experimental Group

Presented in Table 2 is the mean post-test scores of the control and experimental group. It can be gleaned from the table that control group has a mean of 7.08, a proficiency of 17.7% and with a competency level of very low. On the other hand, the experimental group has a mean of 10.05, a proficiency of 25.13% and with a competency level of low.

Parameter	Mean	t-value	p-value	Remarks
Pretest	6.43	-2.88	0.000	Significant
Post-test	7.08			

Table 3 Mean Difference Between the Pretest and the Post-test Scores of Control Group

Table 3 presents the mean difference of the pretest and post-test scores of the control group and its statistical significance. As shown in the table, the pretest score is 6.43, while the post-test score is 7.08. T-test for dependent samples revealed a t-value of -2.88, and p-value of 0.000. The p-value is less than the alpha, 0.05 which indicates that the mean difference in the scores is significant.

Parameter	Mean	t-value	p-value	Remarks
Pretest	7.02	-4.89	0.000	Significant
Post-test	10.05			

Table 4 Mean Difference Between the Pretest and the Post-test Scores of Experimental Group

Table 4 presents the mean difference of the pretest and post-test scores of the experimental group and its statistical significance. As shown in the table, the pretest score is 7.02, while the post-test score is 10.05. T-test for dependent samples revealed a t-value of -4.89, and p-value of 0.000. The p-value is less than the alpha, 0.05 which indicates that the mean difference in the scores is significant

Group	Mean	t-value	p-value	Remarks
Control	7.80	2.14	0.036	Significant
Experimental	10.05			

Table 5 Mean Difference on the Post-test Scores of the Control and Experimental Group

Table 5 presents the mean difference of the post-test scores of the control and experimental groups and its statistical significance. As shown in the table, the control group has a mean post-test score of 7.80 while the experimental group is 10.05. T-test for independent samples revealed a t-value of 2.14, and p-value of 0.036. The p-value is less than the alpha, 0.05 which indicates that the mean difference in the scores is significant.

4. CONCLUSIONS

Based on the findings, there is sufficient evidence to conclude that the mean pretest scores of the control and experimental group are at par with each other. With reference to the competency level description, both groups are described as low which implies that they are of equal level before the intervention.

The mean post-test score of the experimental group is higher when compared to the control group. The experimental group has a competency level of moderate while the control group is low.

When comparing the mean differences of the pretest and post-test scores, the control group showed significant difference in the test results. In the same manner, the experimental group's post-test score is also significantly higher than the pretest score.

Examining the mean differences of the scores showed that the experimental group scored significantly higher than the control group.

With these, the findings are conclusive to reject the null hypotheses of this study. Moreover, the technology integration has a significant impact on the academic achievement of the students in mathematics.

4.1 Recommendations

Based on the conclusions derived from the findings of the study, the following recommendations are hereby presented:

1. The school administrators may support the endeavors of the teachers in raising the academic achievement of the students through capacitating them to fully utilize technology in their teaching.

2. Teachers may take advantage on trainings on integrating technology in mathematics classes.

3. Future researchers may further validate the findings through using a bigger group.

5. REFERENCES

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